stabilizing optical wavelength, for example the optical wavelength detector 120 and part of the mode selector 130, may be installed on the side of the optical signal transmission system, and the remaining component elements may be installed on the side of the optical transmitter. The control apparatus and method according to this invention are also applicable to a modulator integrated type of laser module which includes integrated modulators for modulating light signals output from the laser diodes.

WHAT IS CLAIMED:

1. A control apparatus for stabilizing the wavelength of light output from a laser element, comprising:

a plurality of control circuits for outputting control signals to control the optical wavelength of said laser element in respectively different control modes, and

selecting means for selecting one of said control circuits according to the external conditions of said laser element, and applying a control signal output from said selected control circuit to said laser element, thereby achieving stabilizing control of optical wavelength in said selected control mode.

2. A control apparatus for stabilizing the wavelength of light output from a laser, comprising:

parameter deviation detecting means for detecting a first

control deviation of one parameter responsible for causing variations of optical wavelength output from the laser from a predetermined target value,

optical wavelength deviation detecting means for detecting a second control deviation of optical wavelength output from the laser from a predetermined target value,

selecting means for selecting either of said first and second control deviations, and

manipulating means for manipulating one of said parameters so that said selected control deviation is reduced.

3. A control apparatus for stabilizing optical wavelength according to Claim 2, wherein one of said parameters is laser temperature.

4. A control apparatus for stabilizing optical wavelength according to Claim 2, wherein one of said parameters is driving current which drives the laser.

5. A control apparatus for stabilizing optical wavelength according to Claim 2, wherein, when said second control deviation is stably detected by said optical wavelength deviation detecting means, said selecting means selects said first control deviation, and when said second control deviation is not stably detected, said selecting means selects said second control deviation.

6. A control apparatus for stabilizing the wavelength of light output from a laser module including a laser element,

a temperature sensor and a cooling/heating element, comprising:

first control means for stabilizing said optical wavelength,

second control means for stabilizing said optical wavelength, and

selecting means for selecting either of said first and second control means according to external conditions, and performing stabilizing control of the optical wavelength of said laser element according to an output signal from the selected control means, wherein:

said first control means comprises a temperature monitor for monitoring the temperature of the laser detected by said temperature sensor, a first comparator for detecting a difference between the output value of the temperature monitor and a laser temperature control target value, and first current control means for controlling the current flowing in said cooling/heating element according to an output signal from said first comparator, and

said second control means comprises an optical coupler for splitting the output light from the laser module, an optical wavelength monitor for monitoring the wavelength of the split output light, a second comparator for detecting a difference between the monitored optical output wavelength value and a wavelength control target value, and second current control

means for controlling the current flowing in said cooling/heating element according to an output signal from said second comparator.

7. A control apparatus for stabilizing optical wavelength according to Claim 6, wherein:

said first and second current control means comprise a common current controller connected to said first and second comparators.

8. A control apparatus for stabilizing optical wavelength according to Claim 6, further comprising:

delay means for delaying current control of said cooling/heating element based on said selected control means by a predetermined time when either of said first and second control means is selected.

9. A control apparatus for stabilizing optical wavelength according to Claim 6, wherein:

said laser module is installed in an optical transmitter,

at least part of said first and second control means and said selecting means is installed in said optical transmitter, and the remaining part is installed in the optical transmitting system for transmitting output light from said laser module.

10. An optical wavelength division multiplexer for transmitting a plurality of light signals having different wavelengths to each other, comprising:

a plurality of laser diodes installed on a common heat

sink,

a temperature controller for controlling the temperature of said heat sink to a predetermined temperature,

an optical sensor for detecting oscillation wavelengths of said laser diodes,

a driving current source for driving said laser diodes, and

a current controller for controlling the currents with which said driving current source drives said laser diodes such that the detected oscillation wavelengths of said laser diodes approach predetermined target wavelengths for each laser diode,

wherein said current controller controls the driving current of one of said plural laser diodes so that it approaches a predetermined target current when the output light from said laser diode has shut down, and a predetermined time from starting optical output has not elapsed.

11. An optical wavelength division multiplexer for transmitting a plurality of light signals having different wavelengths to each other, comprising:

a plurality of laser diodes,

a driving current source for driving said laser diodes,

an optical sensor for detecting oscillation wavelengths of said laser diodes,

a temperature sensor for detecting temperatures of said

laser diodes, and

a temperature controller for controlling the temperature of each of said laser diodes so that a detected oscillation wavelength approaches a predetermined target wavelength for the laser diode when the oscillation wavelength of the laser diode is stably detected, and for controlling the temperature of each of said laser diode to a predetermined temperature for each laser diode when the oscillation wavelength of said laser diode is not stably detected.

12. A control method for stabilizing the wavelength of light output from a laser element, comprising the steps of:

selecting one of a plurality of control circuits for outputting control signals for controlling the optical wavelength of said laser element in respectively different control modes according to the external conditions of said laser element, and

applying a control signal output from said selected control circuit to said laser element, thereby achieving stabilizing control of optical wavelength in said selected control mode.

13. A control method for stabilizing the wavelength of light output by a laser, comprising:

detecting a first control deviation of one parameter responsible for causing variations of optical wavelength output from the laser from a predetermined target value,

detecting a second control deviation of optical wavelength output from the laser from a predetermined target value,

selecting either of said first and second control deviations, and

manipulating one of said parameters so that said selected control deviation is reduced.

14. A method for stabilizing optical wavelength according to Claim 13, wherein one of said parameters is laser temperature.

15. A method for stabilizing optical wavelength according to Claim 13, wherein one of said parameters is driving current for driving said laser.

16. A method for stabilizing optical wavelength according to Claim 13, wherein in said selecting step, when said second control deviation is stably detected in said optical wavelength deviation detecting step, said first control deviation is selected, and when said second control deviation is not stably detected in said optical wavelength deviation detecting step, said second control deviation is selected.